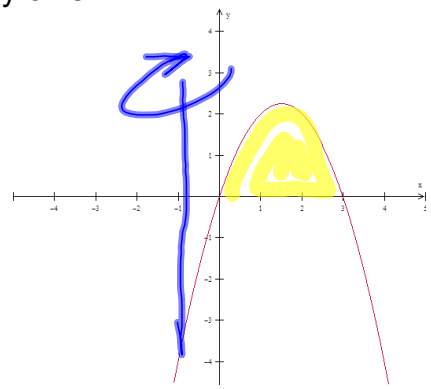
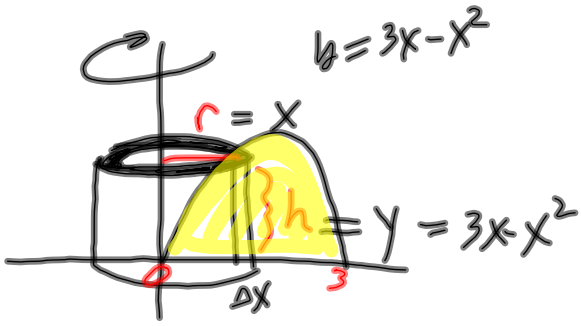
7.3b Volumes

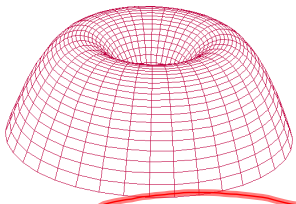
cylindrical shells

Revolve the region bounded by y=3x-x^2 and the x-axis about the y-axis



Find the volume using the shell method





shell

$$\int_a^b 2\pi r h \, dx$$

$$\int_0^3 2\pi x \left(3x - x^2\right) dx$$

$$= 22\frac{1}{2}\pi$$

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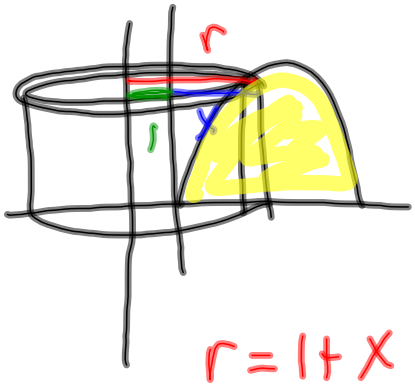

$r = 1 + x$

$h = y = 3x - x^2$

$$\int_0^3 2\pi (1+x)(3x-x^2)\,dx$$

$$= \frac{45\pi}{2}$$

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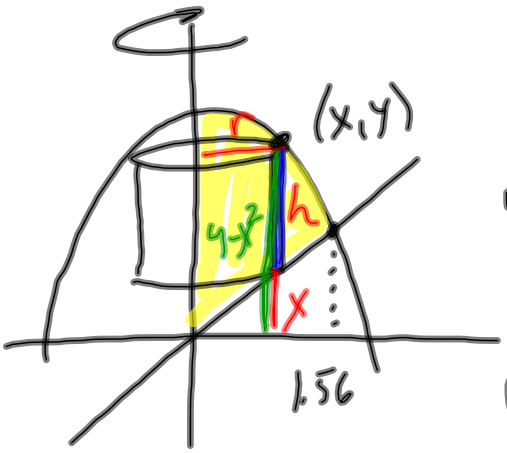
The region bounded by the curves y = 4-x^2, y=x and x=0 is revolved about the y-axis to form a solid. Use shells to find the volume of the solid.



$$\int_0^{1.56} 2\pi r h\,dx$$

$r = x$ $\quad h = (4-x^2) - (x)$

$h = 4 - x^2 - x$

$$\int_0^{1.56} 2\pi x\left(4-x^2-x\right)dx$$

13.327

$x + h = 4 - x^2$

$h = 4 - x^2 - x$

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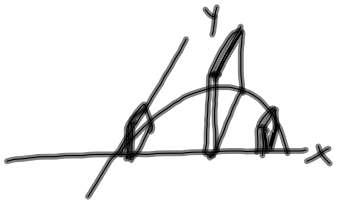
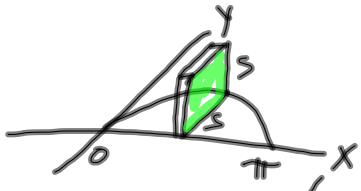
Other cross sections

The base of a solid is the region between the x-axis and one arch of the curve y=2sin(x). Each cross section cut perpendicular to the x-axis is a square whose edge runs from the x-axis to the curve.





$V = \int_a^b A(x)\,dx$

$s = y = 2\sin x$

$$\int_0^\pi s^2\,dx = \int_0^\pi (2\sin x)^2\,dx$$

$$= 2\pi$$

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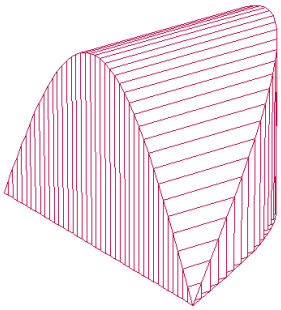
Find the volume



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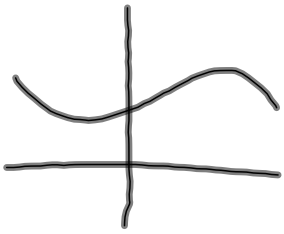
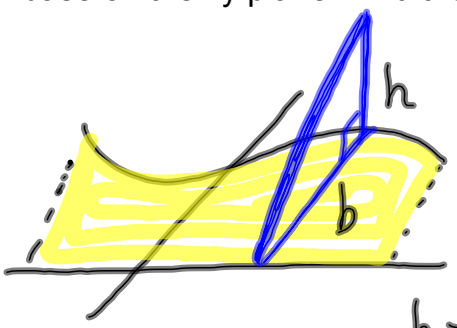
The base of a solid lies between y=2+xcos(x) and the x-axis from x=-2 to x=2. The cross sections perpendicular to the x-axis are isosceles right triangles with base on the xy plane. Find the volume.





$b = h = y$

$= 2 + x\cos x$

$$\int_{-2}^{2} \frac{1}{2} b \cdot h \, dx$$

$$\int_{-2}^{2} \frac{1}{2} (2 + x\cos x)^2 \, dx$$

8.344

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